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(71) Applicant (for all designated States except US): **RESMED LIMITED [AU/AU];** Legal Department, 97 Waterloo Road, North Ryde, NSW 2113 (AU).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **GUNARATNAM,**

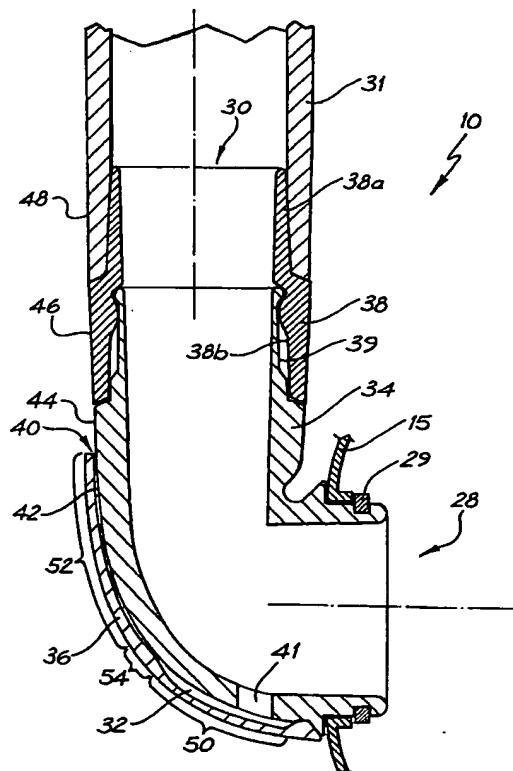
**Michael, Kassipillai [AU/AU];** 3 Keiley Street, Marsfield, NSW 2122 (AU). **DREW, Joanne, Elizabeth [AU/AU];** 19 White Street, Balgowlah, NSW 2093 (AU). **CRUMBLIN, Geoffrey [AU/AU];** 17 Benwerrin Avenue, Baulkham Hills, NSW 2153 (AU). **JENKINSON, Phillip [GB/AU];** 19 Dent Street, Epping, NSW 2121 (AU). **LYNCH, Susan, Robyn [AU/AU];** 98 Henley Marine Drive, Rodd Point, NSW 2046 (AU).

(74) Agent: **SPRUSON & FERGUSON;** G.P.O. Box 3898, Sydney, NSW 2001 (AU).

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(54) Title: **A CONNECTOR FOR A RESPIRATORY MASK AND A RESPIRATORY MASK**



(57) Abstract: A respiratory mask (100), or a connector (10) for a respiratory mask and a supply conduit (31), having a gas washout vent passage (32, 110). The passage inlet is adjacent to, or forms part of, the mask shell (102) in fluid communication with the interior of the mask (100) and an outlet (40, 118) in fluid communication with atmosphere. The outlet interior surface forms a smooth prolongation with an adjacent exterior surface of the mask (100), or the connector (10), and directs the washout gas, respectively, in a direction substantially parallel to the longitudinal axis of the mask inlet (106) and away from the mask inlet (106) or substantially parallel to the longitudinal axis of the supply conduit (31) and towards the supply conduit end (30).

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## A CONNECTOR FOR A RESPIRATORY MASK AND A RESPIRATORY MASK

### FIELD OF THE INVENTION

The present invention relates to a connector for a respiratory mask and a  
5 respiratory mask.

The invention has been developed primarily for use with a breathable gas  
supply apparatus in Continuous Positive Airway Pressure (CPAP) treatment of, for  
example, Obstructive Sleep Apnea (OSA) and other ventilatory assistance treatments  
such as Non Invasive Positive Pressure Ventilation (NIPPV) and will be described  
10 hereinafter with reference to these applications. However, it will be appreciated that the  
invention is not limited to these particular fields of use and also finds application in, for  
example, assisted respiration, mechanical ventilation and the like.

### BACKGROUND OF THE INVENTION

CPAP treatment is a common ameliorative treatment for breathing disorders  
15 including OSA. CPAP treatment, as described in US Patent No. 4,944,310, provides  
pressurised air or other breathable gas to the entrance of a patient's airways at a  
pressure elevated above atmospheric pressure, typically in the range 3-20 cm H<sub>2</sub>O.

It is also known for the level of treatment pressure to vary during a period of  
treatment in accordance with patient need, that form of CPAP being known as  
20 automatically adjusting nasal CPAP treatment, as described in US Patent No.  
5,245,995.

NIPPV is another form of treatment for breathing disorders which can involve  
a relatively higher pressure of gas being provided in the patient mask during the  
inspiratory phase of respiration and a relatively lower pressure or atmospheric pressure  
25 being provided in the patient mask during the expiratory phase of respiration.

In other NIPPV modes the pressure can be made to vary in a complex manner  
throughout the respiratory cycle. For example, the pressure at the mask during  
inspiration or expiration can be varied through the period of treatment, as disclosed in  
the applicant's international PCT patent application No. PCT/AU97/00631.

30 Typically, the ventilatory assistance for CPAP or NIPPV treatment is delivered  
to the patient by way of a respiratory, preferably nasal, mask. Alternatively, a mouth  
mask or full face mask can be used. In this specification any reference to a mask is to  
be understood as incorporating a reference to a nasal mask, mouth mask or full face  
mask, unless otherwise specifically indicated.

35 In this specification any reference to CPAP treatment is to be understood as  
embracing all of the above described forms of ventilatory treatment or assistance.

Breathable gas supply apparatus broadly comprise a flow generator constituted by a continuous source of air or other breathable gas generally in the form of a blower driven by an electric motor. The electric motor driving the blower is typically controlled by a servo-controller under the control of a micro controller unit. A hospital  
5 piped supply can also be used. The gas supply is connected to a conduit or tube, which in turn is connected to the patient's mask which incorporates, or has in close proximity, a gas washout vent for venting exhaled gases to atmosphere. The gas washout vent is sometimes referred to as a CO<sub>2</sub> washout vent.

As CPAP and NIPPV treatments are normally administered while the patient is  
10 sleeping, which makes minimisation of the noise desirable for both the comfort of the patient and any bed partner. The exhausting of exhaled gas to atmosphere through the gas washout vent creates noise due to turbulence generated at a shear layer between the moving vented gases and the still atmospheric air.

It is also desirable to locate the vent as close as possible to the mask in a  
15 location which encourages a circulation of flow within the mask so as to eliminate exhaled CO<sub>2</sub> through the vent and encourage inhalation of the supplied breathable gas. In this way, the retention of CO<sub>2</sub> within the mask is minimised. Further, by increasing the venting efficiency in this manner, the overall gas outflow is minimised thereby reducing the opportunity for noise production.

20 One approach to minimise the noise generated by the venting of the exhaled gas is to direct the gas along an exterior surface which is a smooth prolongation of an interior surface of the outlet of the gas washout vent. This reduces the interaction between the vented gas and the still atmospheric air and thus the noise generated.

An example of the above approach is the AeroClick vent produced by MAP  
25 which has an annular vent passage that directs the exhaled gases along an adjacent cylindrical section of equal exterior diameter to the interior diameter of the annular vent. The AeroClick vent suffers from several disadvantages. Firstly, the annular vent is incorporated into a swivel mechanism which requires a certain amount of play or clearance in order to rotate freely. This play allows the components forming the  
30 interior and exterior surfaces of the annular vent passage to become misaligned and the size of the vent outlet being decreased from optimum in some regions and increased from optimum in other regions. The decreased area regions increase by the velocity of the gas flowing therethrough which increases noise and can produce an unpleasant whistling effect. Secondly, the flow of the gas from the vent outlet to a state where its  
35 velocity is in substantial equilibrium with atmosphere is interrupted by an external shoulder closely downstream of the vent outlet. The shoulder is provided to locate the gas supply conduit. The stresses in the flow caused by the shoulder lead to the

generation of noise. Additionally, the flow path from the gas conduit into the vent outlet is not smooth which introduces discontinuities into the flow which result in further noise generation.

Further, the AeroClick vent, and other prior art devices that are of a substantially cylindrical in line configuration, the exhaled gas must thus be forced a relatively large distance (typically around 60 mm) before reaching the outlet to atmosphere. This reduces CO<sub>2</sub> washout efficiency, as noted above, and requires additional patient effort to force the gas against the direction of flow coming from the flow generator.

It is an object of the present invention to substantially overcome or at least ameliorate the prior art disadvantages and, in particular, to reduce the noise generated by venting exhaled gases to atmosphere.

#### SUMMARY OF THE INVENTION

Accordingly, in a first aspect, the present invention provides a connector comprising:

a mask end for connecting in fluid communication with the interior of a respiratory mask;

a supply conduit end disposed at an angle to the mask end for connecting in fluid communication with the outlet of a breathable gas supply conduit; and

a gas washout vent passage having an inlet adjacent to, or forming part of, the mask end in fluid communication with the interior of the respiratory mask and an outlet in fluid communication with atmosphere, the outlet including an interior surface that forms a smooth prolongation with an adjacent exterior surface of the connector, the vent outlet is disposed on the side of the connector remote the mask end, has a generally part-annular cross section and is adapted to direct the washout gas in a direction substantially perpendicular to the longitudinal axis of the mask end and substantially parallel to the longitudinal axis of the supply conduit end towards the supply conduit end.

The supply conduit end is preferably substantially perpendicular to the mask end. The supply conduit end can also be angled at approximately 135 degrees to the mask end.

Preferably, the connector includes a body portion and a cap portion, said body portion including said interior surface. The cap portion preferably also includes an interior surface spaced apart from the body portion interior surface, said body portion interior surface and said cap portion interior surface defining said vent passage therebetween.

The cap portion is desirably detachable from the body portion. The cap portion and body portion are also desirably rigid and fixed relative to each other when attached. The exterior of the body portion preferably includes grooves or ridges adapted to engage ridges or grooves respectively on the interior of the cap portion to  
5 attach the cap portion to the body portion. One of the body portion or cap portion preferably also includes a spacer extending between said cap portion interior surface and said body portion exterior surface.

In one form, the vent passage inlet is formed in the body portion adjacent to, and downstream of, the mask end, relative to the washout gas flow, and is in fluid  
10 communication with the mask interior via the body portion.

In another form, the vent passage inlet comprises part of the mask end and is in direct fluid communication with the mask interior.

The vent passage preferably comprises an inlet portion of relatively large cross sectional area adjacent the vent passage inlet and an outlet portion of relatively small  
15 cross sectional area adjacent the vent passage outlet.

The vent passage desirably comprises an inlet portion of constant cross section, a relatively long outlet portion of constant cross section and a relatively short transition portion of smoothly reducing cross section extending from the inlet portion to the outlet portion. This shape reduces turbulence and affords a pressure drop from the interior of  
20 the mask to the outlet of the vent passage which reduces the pressure gradient at the outlet of the vent passage and thus reduces the noise generated.

The vent passage can also include internal ribs and/or an internal tortuous path to increase the pressure drop, if required.

The body portion is preferably of generally part toroidal shape. The cap  
25 portion is preferably of complimentary shape to a portion of the exterior of the body portion.

The vent passage preferably curves around the exterior of the body portion.

The connector desirably includes a swivel joiner at its supply conduit end, the exterior of the swivel joiner forming all, or a part, of said connector exterior surface.

In one form, the supply conduit end of the connector forms a smooth  
30 prolongation with the supply conduit. The supply conduit end and the supply conduit desirably have a substantially equal external diameter.

In another form, the swivel joiner forms a smooth prolongation with the supply conduit. The swivel joiner and the supply conduit having a substantially equal external  
35 diameter. The swivel joiner preferably includes an end of reduced external diameter adapted to be received within the interior of the supply conduit.

In a second aspect, the present invention provides a respiratory mask comprising:

a mask shell defining an interior of the respiratory mask;

5 a mask inlet for connecting in fluid communication with the outlet of a breathable gas supply conduit; and

a gas washout vent passage having an inlet forming part of the mask shell and in fluid communication with the interior of the respiratory mask and an outlet in fluid communication with atmosphere, the outlet including an interior surface that forms a smooth prolongation with an adjacent exterior surface of the mask shell, the vent outlet  
10 is disposed on the side of the mask remote the mask interior and is adapted to direct the washout gas in a direction substantially parallel to the longitudinal axis of the mask inlet and away from the mask inlet.

Preferably, the mask shell includes a body portion and a cap portion, said body portion including said interior surface. The cap portion preferably also includes an  
15 interior surface spaced apart from the body portion interior surface, said body portion interior surface and said cap portion interior surface defining said vent passage therebetween.

The cap portion is desirably detachable from the body portion. The cap portion and body portion are also desirably rigid and fixed relative to each other when  
20 attached. The exterior of the body portion preferably includes grooves or ridges adapted to engage ridges or grooves respectively on the interior of the cap portion to attach the cap portion to the body portion. One of the body portion or cap portion preferably also includes a spacer extending between the interior surface of the cap portion and the exterior surface of the body portion.

25 The vent passage preferably comprises an inlet portion of relatively large cross sectional area adjacent the vent passage inlet and an outlet portion of relatively small cross sectional area adjacent the vent passage outlet.

The vent passage desirably comprises a relatively long inlet portion of constant cross section, a relatively long outlet portion of constant cross section and a transition  
30 portion of smoothly reducing cross section extending from the inlet portion to the outlet portion.

The vent passage preferably substantially follows the shape of the exterior of the body portion.

## BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side view of a first embodiment of a connector in accordance with the first aspect of the invention, shown attached to a nasal respiratory mask and forehead support;

5 Fig. 2 is a cross-sectional side view of the connector shown in Fig. 1;

Fig. 3 is a perspective view of the connector shown in Fig. 1;

Fig. 4 is a perspective view of the connector shown in Fig. 1 with the cap portion removed;

10 Fig. 5 is an underside perspective view of the cap portion of the connector shown in Fig. 1;

Fig. 6 is a cross-sectional side view of a second embodiment of a connector in accordance with the first aspect of the invention;

Fig. 7 is a cross-sectional side view of a third embodiment of the connector in accordance with the first aspect of the invention;

15 Fig. 8 is a cross-sectional side view of a first embodiment of a respiratory mask in accordance with the second aspect of the invention; and

Fig. 9 is a cross-sectional side view of a fourth embodiment of the connector in accordance with the first aspect of the invention

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

20 Figs. 1 to 5 show a first embodiment of the first aspect of the invention in the form of connector 10. The connector 10 is shown attached to a nasal respiratory mask 12 and forehead support device 14. The connector 10 is also suitable for use with a full face (ie. nose and mouth) respiratory mask.

25 The mask 12 is comprised of a substantially rigid mask shell 15, a flexible mask cushion 16 and two slotted lower head strap connectors 18 (only one connector shown).

The forehead support 14 includes a lower portion 20 which is pivotally mounted to an upper portion 22. The upper portion 22 includes forehead cushions 24 and two slotted upper head strap connectors 26 (only one cushion/connector shown).

30 As best shown in Fig. 2, the connector 10 includes a mask end 28 for connecting in fluid communication with the interior of the respiratory mask 12 and a supply conduit end 30 disposed substantially perpendicularly to the mask end 28 for connecting in fluid communication with the outlet of a breathable gas supply conduit 31. The mask end 28 is rotatably coupled to the mask shell 15 by a retaining ring 29.

35 The close proximity of the inlet ports 41, and the vent passage 32 overall, to the interior of the mask 12 advantageously increases CO<sub>2</sub> washout efficiency.



The connector 10 also includes a gas washout vent passage, indicated generally by the reference numeral 32, a body portion 34, a detachable cap portion 36 and a detachable swivel joiner 38. The conduit 31 is a non-rotatable friction push fit over end 38a of the swivel joiner 38. The end 38b of the swivel joiner 38 is a rotatable snap-engage fit with reduced diameter portion 39 of the body portion 34. The portion 39 is formed from resilient fingers to allow flexing during snap-engagement with the swivel joiner 38.

The vent passage 32 includes a pair of inlet ports 41 (see Fig. 4) formed in the body portion 34 of the connector 10 adjacent the mask end 28. The inlet ports 41 are in fluid communication with the interior of the mask 12 via the mask end 28. The vent passage 32 also includes an outlet 40 opening to atmosphere. The outlet 40 includes an interior surface 42 (comprising an exterior surface of the body portion 34) that forms a smooth prolongation with an adjacent exterior surface 44 of the body portion 34. The smooth prolongation between the interior surface 42 and exterior surface 44 reduces noise by allowing the exhaled gases to vent along a continuous surface, as previously described. In order to minimise interruptions or disturbances that could generate turbulence downstream of the outlet 40, and thus noise, the adjacent exterior surfaces 46, 48 of the swivel joiner 38 and the gas supply conduit 31 respectively are also formed as smooth prolongations of the interior surface 42 and adjacent exterior surface 44.

As best shown in Fig. 3, the vent passage outlet 40 is of generally part annular cross-section subtending an angle of approximately  $180^\circ$  and is located on the side of the connector 10 remote the mask end 28 and thus the mask 12. This ensures that gas is only vented along surfaces displaced, and facing away, from the mask 12 and the patient, which again minimises the risk of the vented gases encountering noise-producing obstructions.

Returning to Fig. 2, it can be seen that the vent passage 32 comprises an inlet portion 50 of relatively large cross-sectional area compared to an outlet portion 52 of relatively small cross-sectional area. This provides a substantial pressure drop across the vent passage 32 and reduces the pressure drop between the outlet 40 and surrounding atmospheric air, again minimising noise production. Also, the outlet portion 52 is relatively long in order to allow the gas to approach a laminar state and thus minimise turbulence before the gas exits to atmosphere. A smooth tapering transition portion 54 is disposed between the inlet portion 50 and the outlet portion 52 which minimises noise production by minimising the introduction of any discontinuities into the gas flow.

As best shown in Figs. 3 and 4 the body portion 34 includes grooves 56 which are adapted to engage with ridges 58 provided on the cap portion 36 to allow the cap portion 36 to be manually attachable/detachable to/from the body portion 34 for ease of cleaning and replacement. As best shown in Fig. 5, the cap portion 36 also includes an interior strengthening rib 60 to provide rigidity and ensure the cross-sectional area of the vent passage 32 is not reduced due to external pressure, as may be caused by the patient rolling over onto their face during sleep. The detachable cap portion 36 also makes disassembly for cleaning easier and allows cap portions of various sizes to be used with a single body portion 34 thereby allowing the size and shape of the vent passage to be easily and quickly varied for particular treatment applications.

Whilst the connector 10 has been described with reference to the swivel joiner 38 being interposed between the connector 10 and the breathable gas supply conduit 31, it will be appreciated that the conduit can be joined directly to the body portion 34 if the ability to swivel is not required or if a swivel is provided elsewhere in the gas supply circuit. In that case, it is, of course, desirable for the external diameter of the gas supply conduit 31 to be equal to the adjacent external diameter of the exterior surface of the body portion 34.

A second embodiment of connector 80 in accordance with the first aspect of the invention is shown in Fig. 6. Like reference numerals to those used in describing the first embodiment are used to indicate like features in the second embodiment.

The primary difference between the connector 10 and connector 80 is that the inlet ports 41 are omitted and an inlet port 82 of the gas washout vent passage 32 is incorporated into the mask end 28 of the connector 80. Thus provides direct fluid communication between the interior of the mask 12 and the vent passage 32 and further minimises CO<sub>2</sub> retention. The inlet portion 50 of the vent passage 32 also provides a relatively long distance over which a gradual reduction in pressure can be achieved. Further, the interior surface of the vent passage outlet 40 forms a smooth prolongation with the adjacent exterior surface 46 of the swivel joiner 38 rather than the body portion 34, as with the first embodiment.

Fig. 7 shows a third embodiment of the connector 90 according to the first aspect of the invention. Like reference numerals to these used in describing the first embodiment will again be used to indicate like features in the third embodiment. The connector 90 also has the vent passage 32 in direct fluid communication with the interior of the mask 12. However, in this embodiment, an inlet port 92 is formed in the mask shell 15.

Fig. 9 shows a fourth embodiment of the connector 130 according to the first aspect of the invention. Like reference numerals to these used in describing the first

embodiment will again be used to indicate like features in the fourth embodiment. The connector 130 also has an inlet port 132 formed in the mask shell 15, similar to the third embodiment. However, in this embodiment, both the interior surface 42 and the smoothly prolongating adjacent exterior surface 46 are provided on the swivel joiner 38. As the gas vents to atmosphere downstream of the join 134 between the swivel joiner 38 and the body portion 34 then any gas leaking through the join 134 can not disturb the flow of gas at, or after, the outlet 40. In this way, a further opportunity for turbulence, and thus noise generation, is eliminated.

Fig. 8 shows a first embodiment of a nasal respiratory mask 100 in accordance with the second aspect of the invention. The mask 100 includes a mask shell 102 and a mask cushion 104. The mask shell 102 includes a mask inlet 106 for connecting in fluid communication with the outlet of the breathable gas supply conduit 108. The mask 100 includes a gas washout vent passage indicated generally by the reference numeral 110.

The mask shell 102 is comprised of a body portion 112 and a detachable/attachable cap portion 114. The vent passage 110 includes an inlet port 116 formed in the body portion 112 of the mask shell 102. The inlet port 116 is in direct fluid communication with the interior of the mask 100. The vent passage 110 also includes an outlet 118 in fluid communication with atmosphere. The outlet 118 includes an interior surface 120 on the exterior of the body portion 112 that forms a smooth prolongation with an adjacent surface 122 also provided on the exterior of the body portion 112. The outlet 118 is adapted to direct the washout gas in a direction substantially parallel to the longitudinal axis of the mask inlet 106 and away from the mask inlet 106.

As with earlier embodiments, the noise produced by venting the exhaled gas to atmosphere is minimised by directing the vented gas on a smooth continuing surface before and after the outlet 118 and away from the mask 100, the patient and other potential disturbances. Additionally, as with the earlier connector embodiments, the cap portion 114 is detachable from the body portion 112 for cleaning and or replacement with a cap portion of same, or different, size or shape. The vent passage 110 also similarly comprises an inlet portion 124 of relatively large cross-sectional area, a relatively long outlet portion 126 of relatively small cross-sectional area and a transition portion 128 of smoothly reducing cross-section extending from the inlet portion 124 to the outlet portion 126.

Although the invention has been described with reference to the preferred embodiments, it will be appreciated by those skilled in the art that the invention may be embodied in many other forms.

## CLAIMS:

1. A connector comprising:
  - a mask end for connecting in fluid communication with the interior of a respiratory mask;
  - 5 a supply conduit end disposed at an angle to the mask end for connecting in fluid communication with the outlet of a breathable gas supply conduit; and
  - a gas washout vent passage having an inlet adjacent to, or forming part of, the mask end in fluid communication with the interior of the respiratory mask and an outlet in fluid communication with atmosphere, the outlet including an interior surface that
  - 10 forms a smooth prolongation with an adjacent exterior surface of the connector, the vent outlet is disposed on the side of the connector remote the mask end, has a generally part-annular cross section and is adapted to direct the washout gas in a direction substantially perpendicular to the longitudinal axis of the mask end and substantially parallel to the longitudinal axis of the supply conduit end towards the
  - 15 supply conduit end.
2. The connector as claimed in claim 1, wherein the supply conduit end is substantially perpendicular to the mask end.
3. The connector as claimed in claim 1, wherein the supply conduit end is angled at approximately 135 degrees to the mask end.
- 20 4. The connector as claimed in claim 1, 2 or 3, wherein the connector includes a body portion and a cap portion, said body portion including said interior surface.
5. The connector as claimed in claim 4, wherein the cap portion includes an interior surface spaced apart from the body portion interior surface, said body
- 25 portion interior surface and said cap portion interior surface defining said vent passage therebetween.
6. The connector as claimed in claim 4 or 5, wherein the cap portion is detachable from the body portion.
7. The connector as claimed in claim 4, 5 or 6, wherein the cap portion
- 30 and body portion are rigid and fixed relative to each other when attached.
8. The connector as claimed in any one of claims 4 to 7, wherein the exterior of the body portion includes grooves or ridges adapted to engage ridges or grooves respectively on the interior of the cap portion to attach the cap portion to the body portion.

9. The connector as claimed in any one of claims 4 to 8, wherein one of the body portion or the cap portion includes a spacer extending between said cap portion interior surface and said body portion exterior surface.

10. The connector as claimed in any one of claims 4 to 9, wherein the vent passage inlet is formed in the body portion adjacent to, and downstream of, the mask end, relative to the washout gas flow, and is in fluid communication with the mask interior via the body portion.

11. The connector as claimed in any one of claims 1 to 9, wherein the vent passage inlet comprises part of the mask end and is in direct fluid communication with the mask interior.

12. The connector as claimed in any one of preceeding claims, wherein the vent passage comprises an inlet portion of relatively large cross sectional area adjacent the vent passage inlet and an outlet portion of relatively small cross sectional area adjacent the vent passage outlet.

13. The connector as claimed in any one of claims 1 to 11, wherein the vent passage comprises an inlet portion of constant cross section, a relatively long outlet portion of constant cross section and a relatively short transition portion of smoothly reducing cross section extending from the inlet portion to the outlet portion.

14. The connector as claimed in any one of the preceeding claims, wherein the vent passage includes internal ribs and/or an internal tortuous path.

15. The connector as claimed in any one of preceeding claims 4 to 14, wherein the body portion is of generally part toroidal shape.

16. The connector as claimed in any one of preceeding claims 4 to 15, wherein the cap portion is of complimentary shape to a portion of the exterior of the body portion.

17. The connector as claimed in any one of preceeding claims 4 to 16, wherein the vent passage curves around the exterior of the body portion.

18. The connector as claimed in any one of the preceeding claims, wherein the connector includes a swivel joiner at its supply conduit end, the exterior of the swivel joiner forming all, or a part, of said connector exterior surface.

19. The connector as claimed in any one of the preceeding claims, wherein the supply conduit end of the connector forms a smooth prolongation with the supply conduit.

20. The connector as claimed in any one of the preceeding claims, wherein the supply conduit end and the supply conduit have a substantially equal external diameter.

21. The connector as claimed in claim 18, wherein the swivel joiner forms a smooth prolongation with the supply conduit.

22. The connector as claimed in claim 21, wherein the swivel joiner and the supply conduit have a substantially equal external diameter.

5 23. The connector as claimed in claim 22, wherein the swivel joiner includes an end of reduced external diameter adapted to be received within the interior of the supply conduit.

24. A respiratory mask comprising:

a mask shell defining an interior of the respiratory mask;

10 a mask inlet for connecting in fluid communication with the outlet of a breathable gas supply conduit; and

a gas washout vent passage having an inlet forming part of the mask shell and in fluid communication with the interior of the respiratory mask and an outlet in fluid communication with atmosphere, the outlet including an interior surface that forms a smooth prolongation with an adjacent exterior surface of the mask shell, the vent outlet is disposed on the side of the mask remote the mask interior and is adapted to direct the washout gas in a direction substantially parallel to the longitudinal axis of the mask inlet and away from the mask inlet.

25. The mask as claimed in claim 24, wherein the mask shell includes a body portion and a cap portion, said body portion including said interior surface.

26. The mask as claimed in claim 25, wherein the cap portion includes an interior surface spaced apart from the body portion interior surface, said body portion interior surface and said cap portion interior surface defining said vent passage therebetween.

25 27. The mask as claimed in claim 26, wherein the cap portion is detachable from the body portion.

28. The mask as claimed in claim 27, wherein the cap portion and body portion are rigid and fixed relative to each other when attached.

30 29. The mask as claimed in any one of claims 25 to 28, wherein the exterior of the body portion includes grooves or ridges adapted to engage ridges or grooves respectively on the interior of the cap portion to attach the cap portion to the body portion.

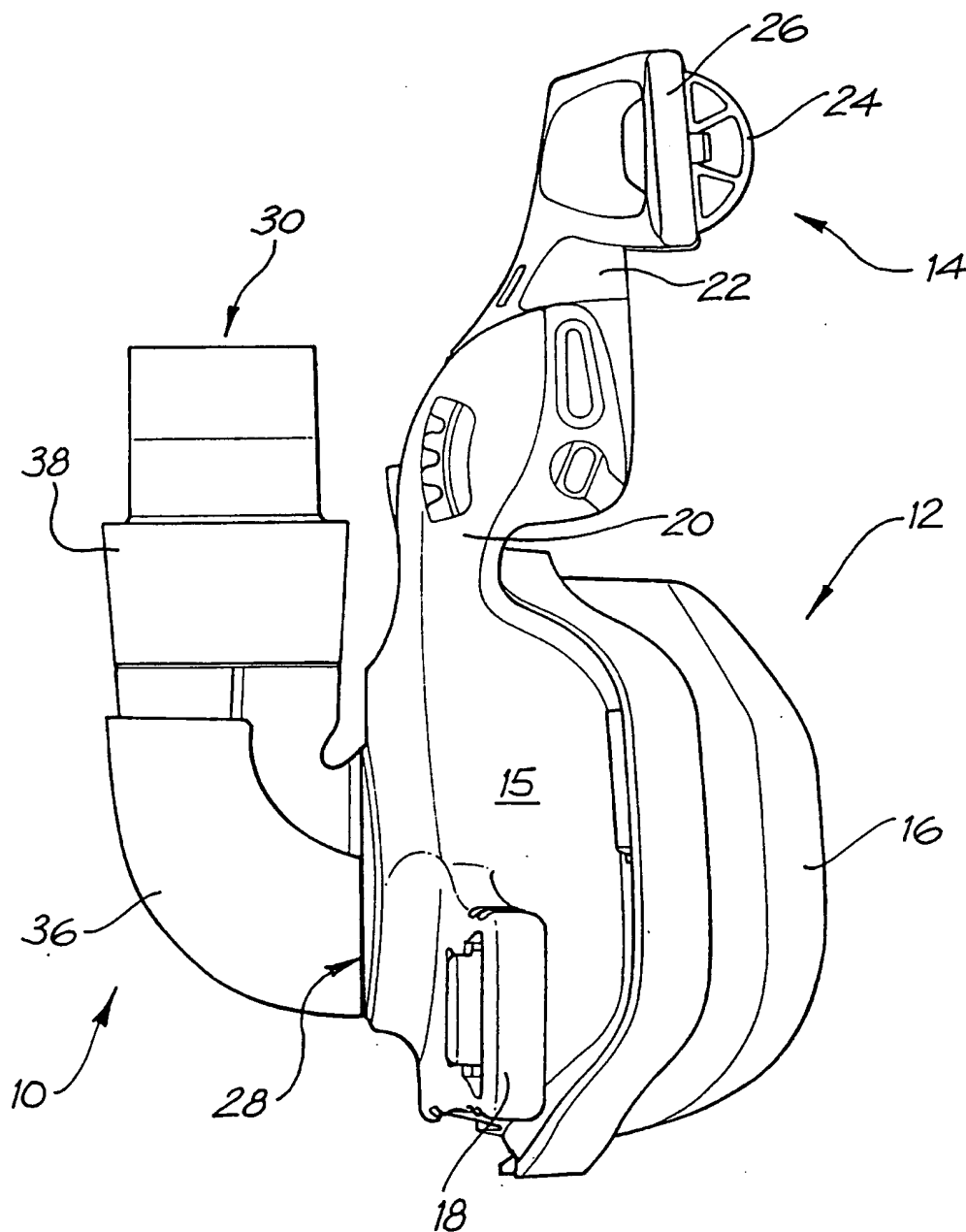
35 30. The mask as claimed in any one of claims 25 to 29, wherein one of the body portion or cap portion includes a spacer extending between the interior surface of the cap portion and the exterior surface of the body portion.

31. The mask as claimed in any one of claims 25 to 30, wherein the vent passage comprises an inlet portion of relatively large cross sectional area adjacent the

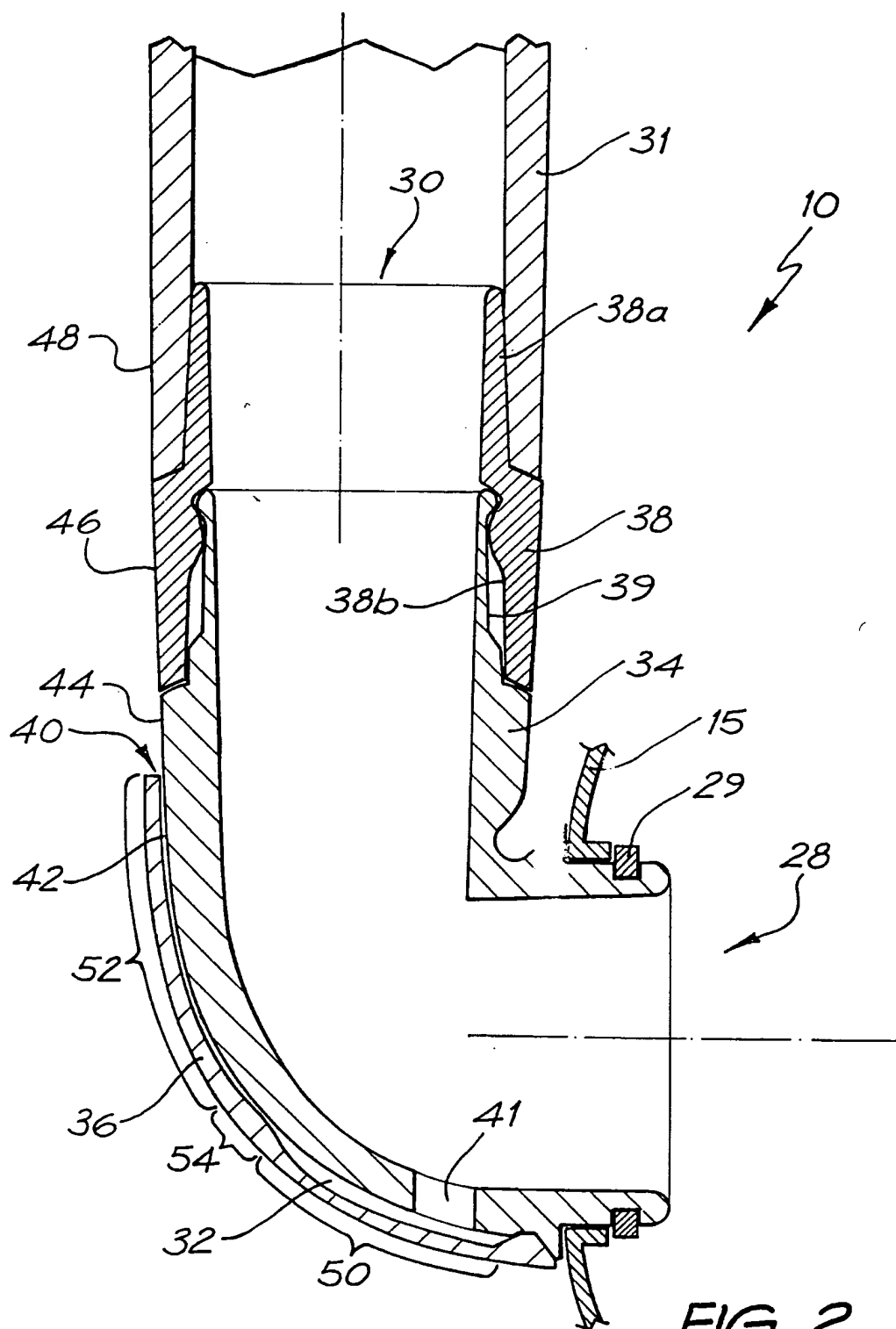
vent passage inlet and an outlet portion of relatively small cross sectional area adjacent the vent passage outlet.

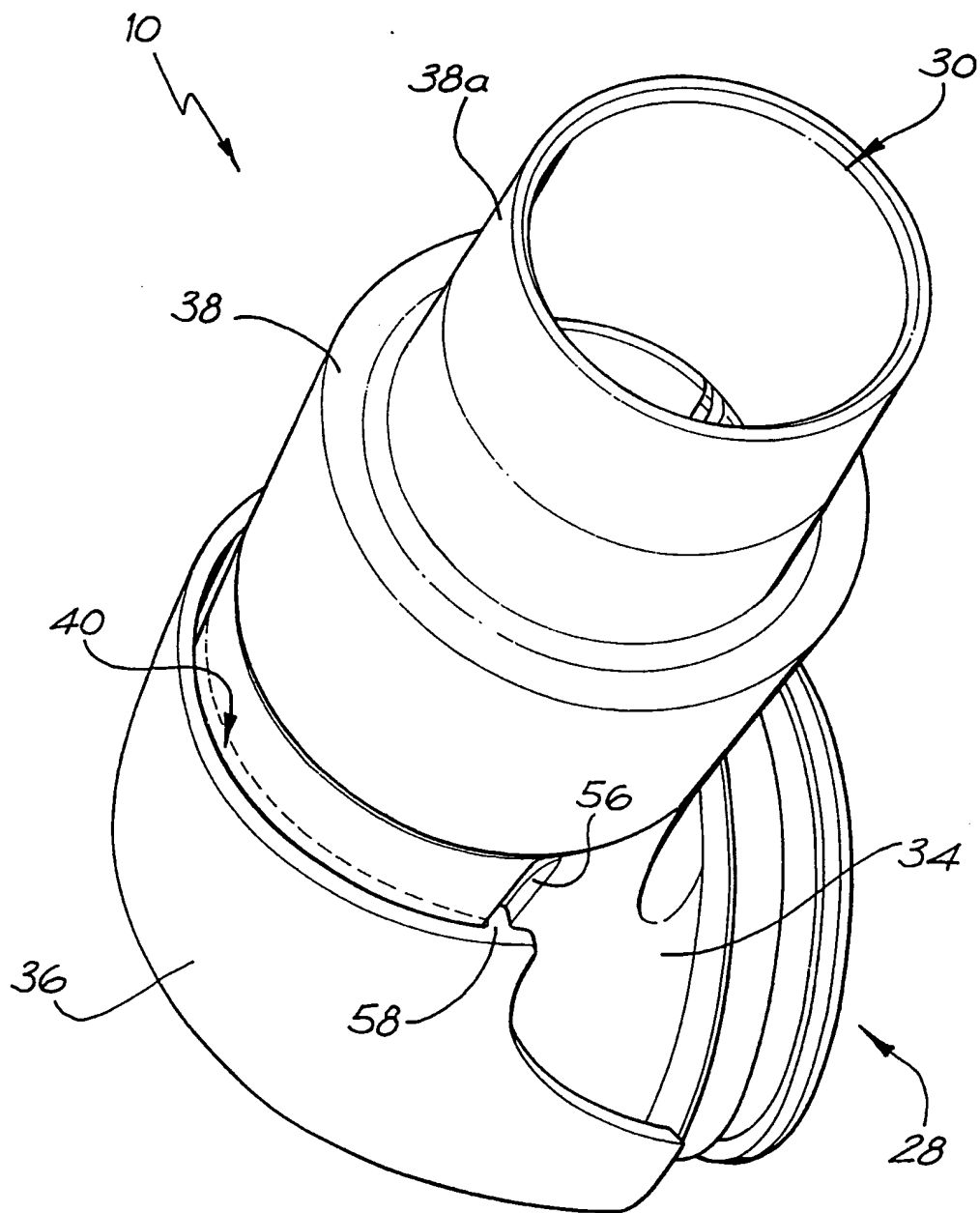
32. The mask as claimed in any one of claims 25 to 30, wherein the vent passage comprises a relatively long inlet portion of constant cross section, a relatively long outlet portion of constant cross section and a transition portion of smoothly  
5 reducing cross section extending from the inlet portion to the outlet portion.

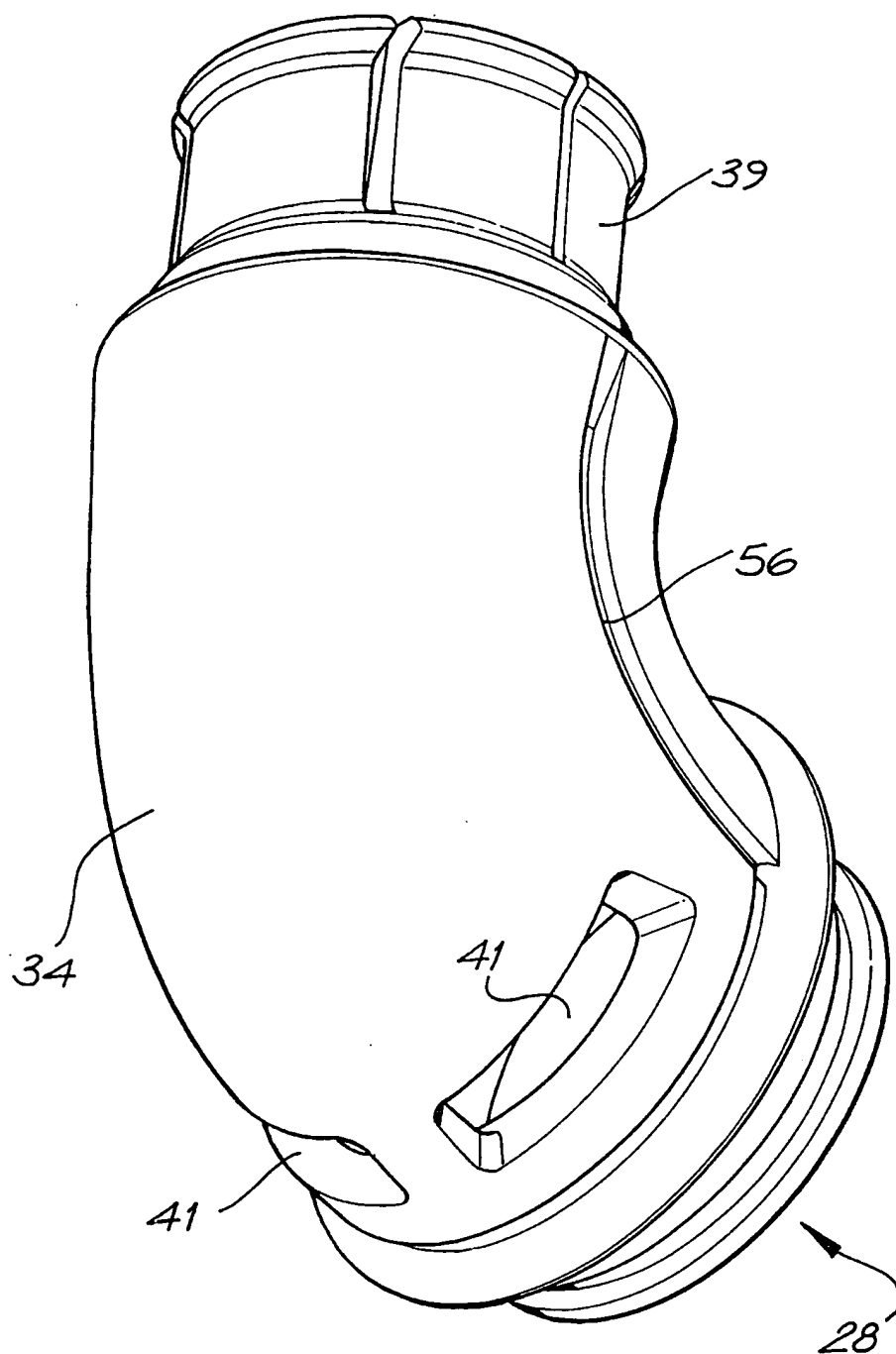
33. The mask as claimed in any one of claims 25 to 32, when the vent passage substantially follows the shape of the exterior of the body portion.

**FIG. 1**





**FIG. 3**

**FIG. 4**

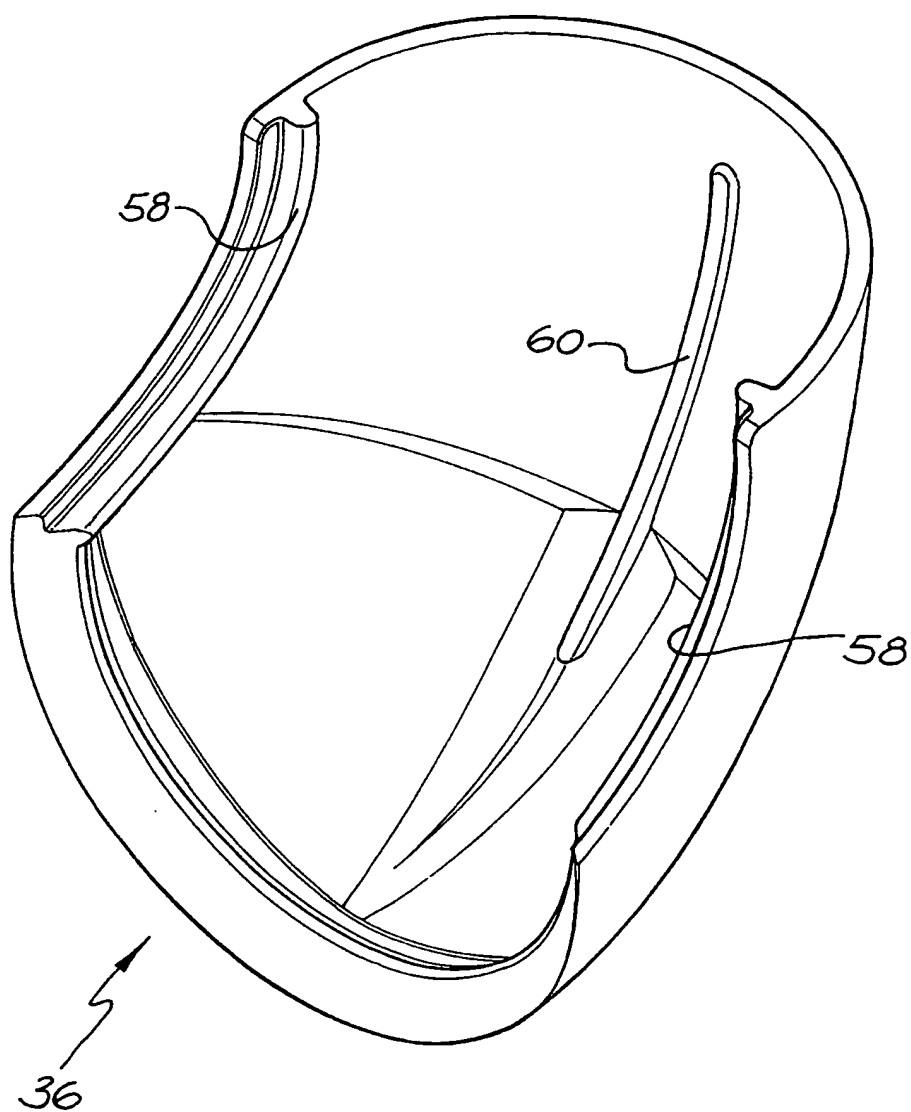
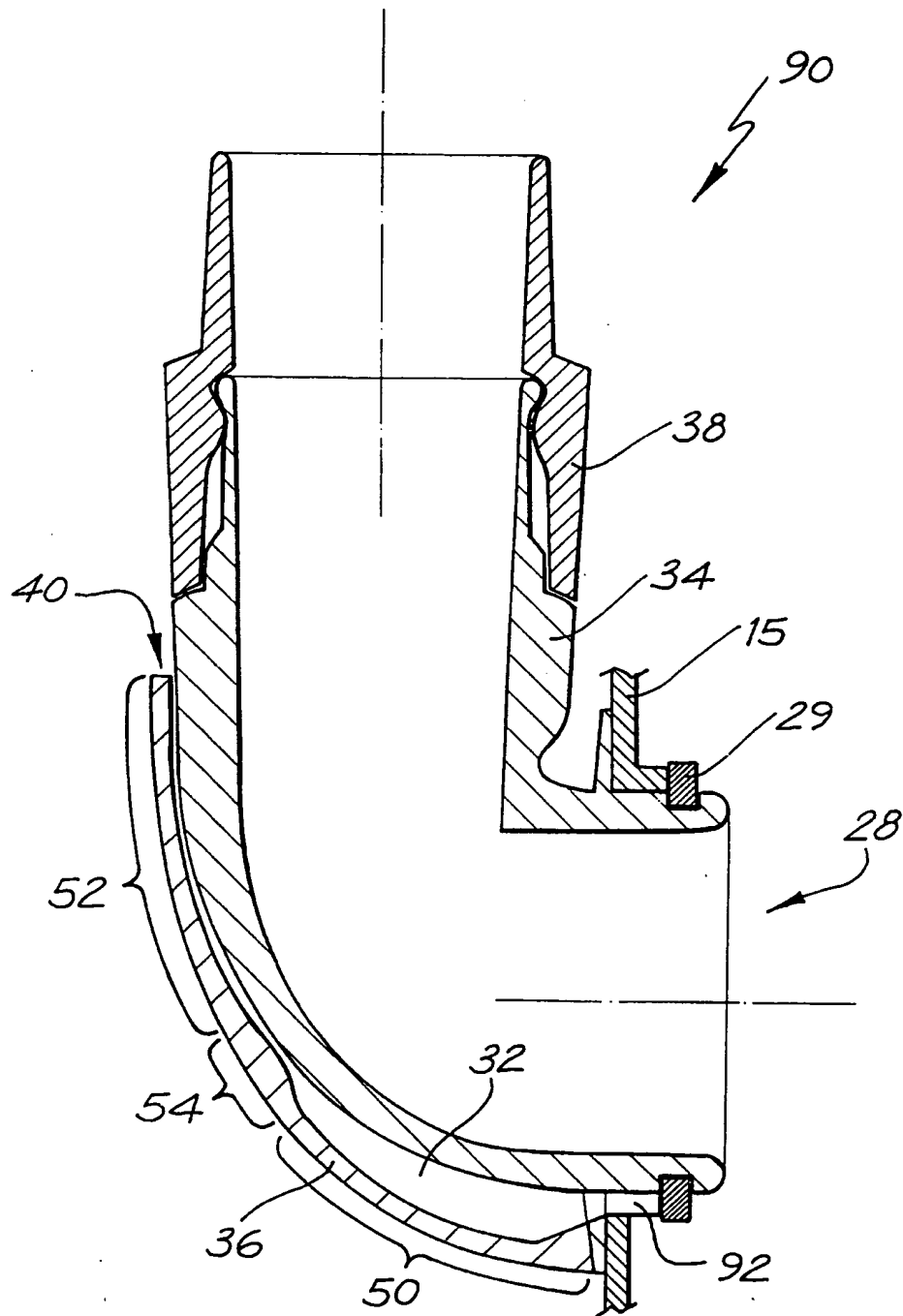


FIG. 5



**FIG. 7**

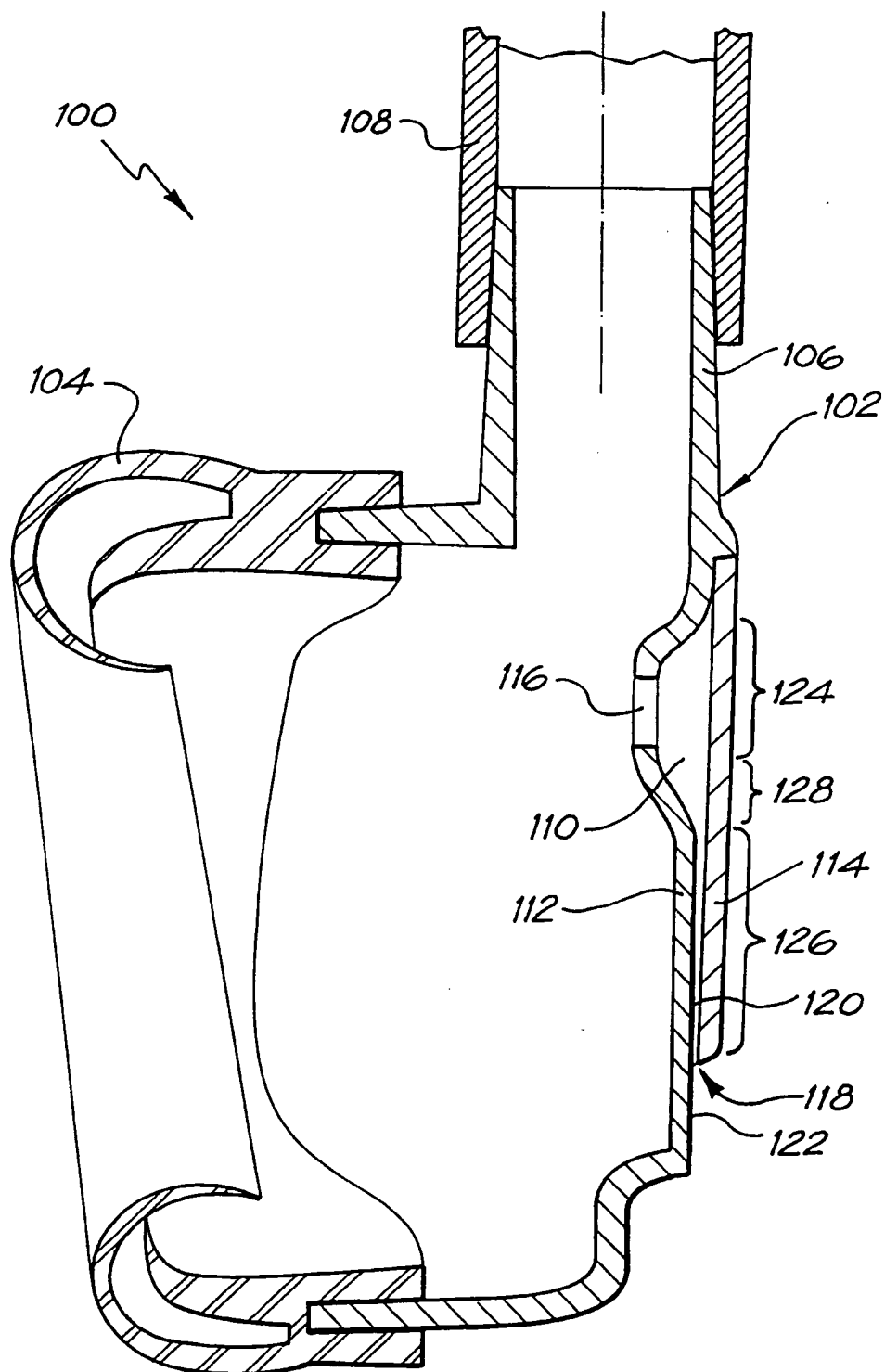
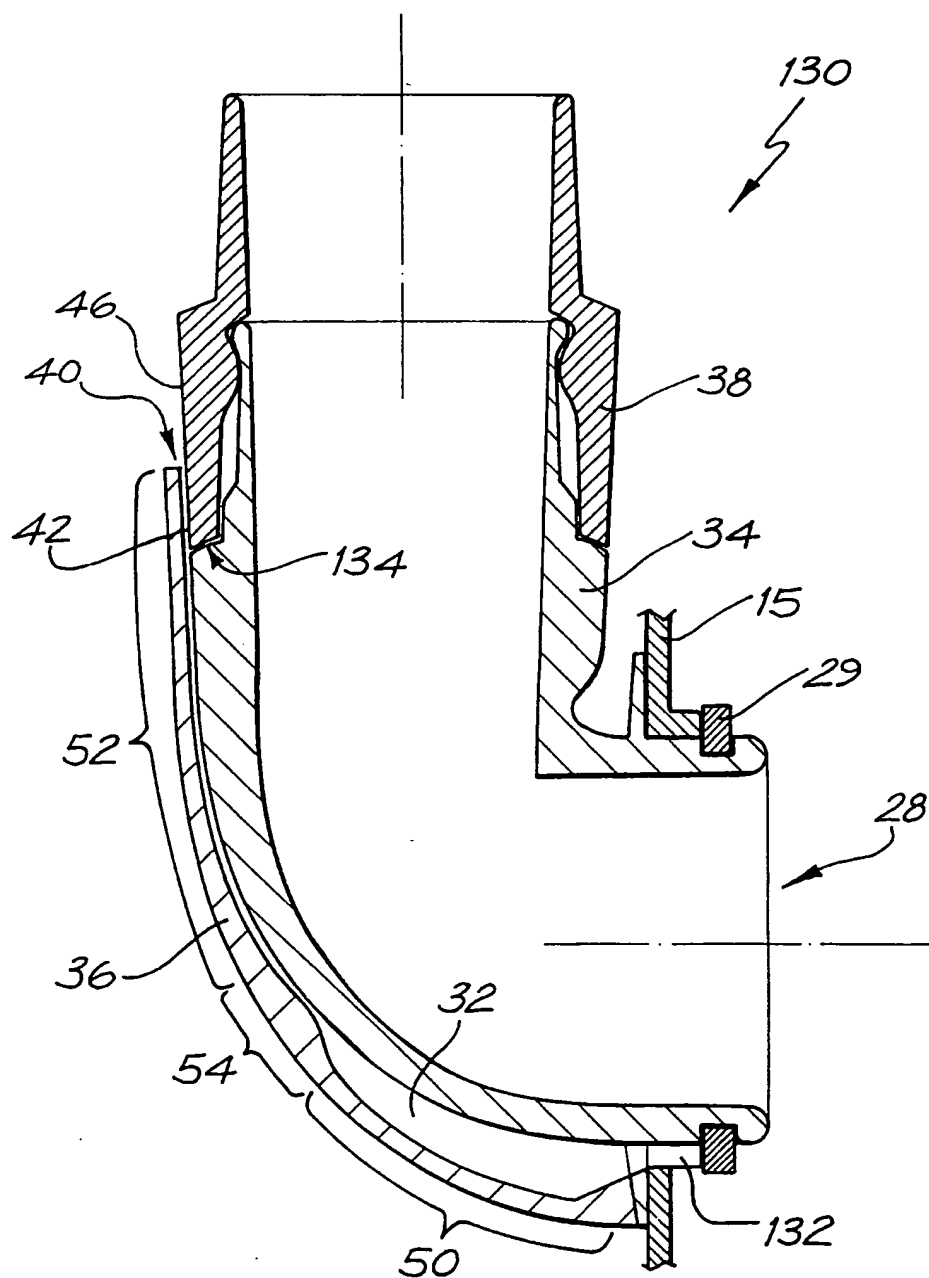


FIG. 8

**FIG. 9**



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU00/00636

**A. CLASSIFICATION OF SUBJECT MATTER**Int. Cl. <sup>7</sup>: A61M 16/06

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

Derwent: mask, respir,vent, exhaust,apnoea,apnea, CPAP, etc

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 98/34665 A (RESMED LTD) 13 August 1998 Figure 1	24
X Y	CA 1039144 A (BARD INC) 26 September 1978 Figures 1-3	24-26, 33 24
X	DE 19757703 (MAP Medizintechnik für Arzt und Patient GmbH) 14 October 1999 Figures 1 and 2	1-7, 9-12, 15-20

☐ Further documents are listed in the continuation of Box C
 ☒ See patent family annex

\* Special categories of cited documents:

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"&amp;" document member of the same patent family

Date of the actual completion of the international search

7 July 2000

Date of mailing of the international search report

13 JUL 2000

Name and mailing address of the ISA/AU

 AUSTRALIAN PATENT OFFICE  
 PO BOX 200, WODEN ACT 2606, AUSTRALIA  
 E-mail address: pct@ipaustalia.gov.au  
 Facsimile No. (02) 6285 3929

Authorized officer

SUE THOMAS

Telephone No : (02) 6283 2454

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

International application No.  
**PCT/AU00/00636**

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report				Patent Family Member			
WO	9834665	AU	53019/98	AU	58476/98	EP	968022
CA	1039144	NONE					
DE	19757703	NONE					
							END OF ANNEX